

56. (Amended) The method of claim 54, wherein said thermosetting material is polyurethane resin.

57. (Amended) The method of claim 54, wherein said thermosetting material contains a surfactant.

58. (Amended) The method of claim 54, wherein said reactive resin is 2-propenoic acid, 2-hydroxypropyl ester, polymer with chloroethene and ethenyl acetate.

59. (Amended) The method of claim 54, wherein said thermoplastic material is PVC.

60. (Amended) The method of claim 54, wherein said PVC has a tensile strength of between 5,000 to 10,000 psi.

#### REMARKS

Applicant wishes to express his sincere gratitude for the courteous and professional interview conducted by the Examiner with Applicant's representatives on April 8, 2002. As noted in the Interview Summary, agreement was reached and it is believed, given the above amendment and the discussion below, that this case is in condition for allowance.

In paragraphs 9 and 11 of the Office Action the Examiner has objected to claims 51 and 58 on the basis that they are indefinite and contain new matter. The Examiner has stated

that the resin/monomers recited in claims 51 and 58 are not recited in the original specification.

As the Examiner has pointed out, the original specification recites the use of 2-propanoic acid, 2-hydroxypropyl ester, chloroethane and ethenyl acetate at page 14, lines 17-18. This reference is misspelled and accordingly has been corrected by amendment above to 2-propenoic acid, 2-hydroxypropyl ester, chloroethene and ethenyl acetate.

Applicant encloses herewith a copy of a printout of the Chemical Abstracts Service (CAS) Registry data for the chemical compound whose CAS Registry Number is 41618-91-1.

The printout discloses 8 alternative names for compound number 41618-91-1. The first name appearing on the printout is 2-propenoic acid, 2-hydroxypropyl ester, polymer with chloroethene and ethenyl acetate, the name originally given at page 14, lines 17-18 of the specification. The seventh name appearing on the printout is poly(vinyl chloride-co-vinyl acetate-co-2-hydroxypropyl acrylate), the name used in claims 51 and 58. Applicant submits that both names are equivalent and acceptable means for identifying the same compound, however, in the interest of consistency of terminology, claims 51 and 58 have been amended to refer to the compound as originally described in the specification.

In paragraph 8 of the Office Action the Examiner has rejected claims 47-60 on the basis that the term "layer" was not used in the original application and therefore constitutes new matter.

Referring to Figure 9 and to pages 21-24 of the specification, a cross-section of the conduit of the present invention is described with reference to specific components thereof. Applicant notes that reference numeral 54 refers to the thermoset region. Applicant wishes to draw the Examiner's attention to page 24 line 9 of the specification where reference is made to "layers or regions of the thermoset region 54". Applicant submits that this contradicts the Examiner's assertion that component (b) of claim 47, namely, the "thermoset layer", is not described by the term "layer" in the specification.

Referring to Figure 10 and to pages 24-26 of the specification, a cross-section of an alternate embodiment of the present invention is described. Applicant notes that reference numeral 128 refers to the thermoplastic region. Applicant submits that the thermoplastic region is described by the term "layer at page 25 lines 18-19 of the specification where reference is made to the "protective layer or sheet region 128".

Applicant submits that at several points in the specification the thermoset and thermoplastic regions of the present invention are variously referred to by the terms "sheet", "region", "layer", "liner", "material", "mixture" and "portion". Examples may be found in the specification at: page 23, line 15; page 23, line 22; page 23, line 26; page 23, line 27; page 24, line 9; page 25, line 18; and page 26, line 22.

Applicant submits that "layer" is simply one of several terms that may be used to describe the components of the

present invention, similar in meaning to terms such as "region", "stratum", "band", "section" and "portion". Applicant further submits that, in light of the specification, it is inherently evident that "layer", in part (a) of claim 47, identifies the mineral, porous substrate component of the invention. Use of "layer" in this sense is analogous to the use of "layer" to refer to the thermoplastic and thermoset layers. Applicant submits that "layer" merely serves to identify a component of the composite structural conduit, which is clearly described in the specification and therefore does not constitute new matter.

In summary, taking into account the specification as a whole, and in light of the preceding argument, Applicant submits that the use of the term "layer" to describe components (a) and (b) of claim 47 does not constitute new matter.

Applicant seeks to provide clearer antecedent support for the term "layer" by amending the specification at page 21 to incorporate a passage identifying the various components of the composite structural conduit as layers.

The Examiner states that claims 47-50, 52-57, and 59-60 are unpatentable over O'ffill in view of Rosemund and Muller and Ranney. More specifically, the Examiner states that:

"[i]t would have been obvious to one having ordinary skill in the art at the time that the invention was made to add the silane adhesion promoters of Ranney to the isocyanate-based

compositions of Rosemund and to employ those compositions as the carriers between the mineral-containing surface and the PVC liner of O'ffill in order to enhance the bonding of the PVC liner to the carrier and the carrier to the conduit surface. The motivation to employ Ranney's silane adhesion promoters in the Rosemund's compositions for use in rehabilitating conduits with PVC liners, such as O'ffill's, is found in Ranney's abstract, where Ranney says that silanes promotes the bonding of polyurethanes to a variety of substrates."

The motivation to use Ranney's silane adhesion promoters in Rosemund's compositions to bond to PVC may, as the Examiner suggests, arise from the abstract of Ranney. The motivation to employ Rosemund's compositions to bond PVC substrates to brick and other substrates may, as the Examiner suggests, come from col. 8, lines 4 and 13-15 of Rosemund. However, contrary to the Examiner's suggestion in the above-quoted passage, there is no suggestion, in Ranney, Rosemund or O'ffill, that such compositions would find application in the bonding of thermoplastic liners for the purpose of rehabilitating pipes or conduits. In fact, to do so would directly contradict the explicit teaching of O'ffill.

In contradistinction to the Examiner's suggestion, the Applicant submits that O'ffill specifically teaches the use of an interlayer that bonds only to the pipe but not to the liner, as is evidenced by the following passages of O'ffill:

"The carrier is preferably formed from a cementitious material, such as cementitious grout and the like that is conventionally used to repair structure surfaces. Alternatively, the carrier can be formed from a resinous material that has good thixotropic properties and good chemical and/or corrosion resistance when cured. The carrier cures to form a strong bond with the surface of the underlying substrate but not with the back side surface of the liner. The liner outwardly projecting members, and more specifically the head portion thereof, are completely surrounded by the carrier and are mechanically locked therein by curing action of the carrier.

The flexible liner of this invention is in the form of a noncontinuous diameter, i.e., is not in tubular form, that allows for the surfacing or rehabilitating of structures other than pipes that have a number of different geometries and sizes. The lack of bond formed between the carrier and liner back side surface permits the liner to remain flexible and insulated from the structure surface, thereby minimizing the possibility that cracks or tears in the flexible liner will develop due to subsequent cracks in the underlying pipe wall." (see O'ffill col. 4, lines 26-47)

"It is desired that the carrier cure to form a strong bond with the surface of the substrate

but not with [the] back side surface of the flexible liner so that the only mechanism retaining the flexible liner against the carrier is the mechanical lock that is formed between the OPMS and the carrier. The formation of a bond between the carrier and the flexible liner back side surface is not desired so that the flexible liner can remain flexible with respect to and independent from the adjacent wall surface. This eliminates the possibility of the flexible liner cracking or tearing as a result of cracks that develop in the substrate 24 and that are transmitted from the wall portion 32 to the carrier 36. Constructed in this manner, the flexible liner 30 is better able to protect against fluid or gas leakage from the pipe due to the development of such pipe cracks. Additionally, the flexible liner is better able to prevent ingress of ground water in to the pipe due to the development of such pipe cracks in applications where the pipe is buried at a depth equal to or below the ground water level. In such cases the ground water passing through the cracks in the pipe is trapped between the pipe wall section and the back side surface of the liner, and is thereby prevented from entering the pipe." (see O'ffill col. 7, lines 13-34)

Applicant submits that the above passages clearly indicate that use of Rosemund's compositions in order to bond to PVC is incompatible with O'ffill because it would result in adhesion of the flexible liner to the carrier. O'ffill

makes no mention of the techniques of Rosemund, although Rosemund was well known in the art at the time of the invention of O'ffill, having issued over 20 years prior.

Applicant reiterates that none of the references cited by the Examiner, alone or in combination, discloses means for strengthening a pipe or conduit. More specifically, there is no suggestion that the method of O'ffill contributes to the tensile, compressive, or flexural strength of the host structure. In fact, it is impossible for the liner of O'ffill to simultaneously remain flexible relative to the conduit and to contribute appreciably to the structural strength of the conduit. The Applicant further submits that it is well known in the art that the method of O'ffill cannot be used to repair pipes or culverts that have lost part of their steel reinforcement due to corrosion, and thus have lost their load bearing capacity. In such cases, new steel reinforcement must be added to the structure before lining with the method of O'ffill.

The applicant submits that, contrary to the teaching of O'ffill, the PVC liner of the present invention is fully and continuously bonded to the thermosetting material (i.e., the carrier), which in turn is bonded to the substrate forming an integrated composite. In this way, the stresses experienced by the structure due to externally and internally applied loads (e.g., earth loads, live loads, hydrostatic pressure from ground water, etc.) are transmitted and transferred to the PVC via the thermosetting material. When stresses are transferred from the corroded host structure to the PVC liner, the host structure is effectively reinforced and the load bearing



capacity of the original structure is improved. The amount of stress transferred from the host structure to the PVC liner depends mainly on the material properties of the PVC liner and thermosetting material, and on the thickness of each of these sections. The most relevant material properties are: (1) The modulus of rigidity and strength of the PVC liner, (2) the shear modulus of rigidity, and shear strength of the thermosetting material, and (3) the normal and shear bond strengths between the thermosetting material and the host structure, and between the thermosetting material and the PVC liner. The treated PVC liner of the present invention is chemically bonded to the thermosetting material by means of strong covalent bonds, rather than the mechanical locking and adhesion of O'ffill. The continuous covalent bonding of the present invention fixes the PVC liner to the thermosetting material so that the PVC liner is not flexible relative thereto (in contrast to the flexible liner of O'ffill). The continuous covalent bonding provides superior transfer of stresses from the host structure to the PVC liner, resulting in a greatly reinforced and strengthened structure.

In particular, the flexural stiffness and strength of the host structure are significantly improved when the method described by the Applicant is applied on faces of the host structure that are under tension as a result of an applied bending moment. This circumstance occurs at the crown of all buried pipes and culverts. In turn, the crown is the part of a concrete pipe or culvert that is most susceptible to hydrogen sulfide induced corrosion, and it is the part that most frequently requires structural repair. Under the above-mentioned circumstances, the PVC sheet, via the

thermosetting material, behaves as tensile steel reinforcement.

The Applicant has proven via testing that the application of the method of the present application can increase the strength of a corroded host pipe with severe structural damage (i.e., missing steel reinforcement) by 300 to 400 percent over the original design strength of the un-corroded pipe. It is important to note that the present invention is able to achieve this strengthening without significantly changing the hydraulic diameter of the host pipe.

At page 7 of the Office Action the Examiner takes official notice that "the isocyanate-based polyurethanes of Rosemund and Ranney are thermosetting materials."

Applicant submits that polymers may be divided into thermoplastics and thermosets. As the names suggest, the former flow or, more precisely, flow more easily, when squeezed, pushed or stretched by a load, usually at elevated temperatures. Thermoplastics hold their shape at room temperatures but can be reheated and formed into different shapes. Thermosets are like concrete, they flow and can be molded when initially constituted, but then become set in their shape, usually through the action of heat and (often) pressure, this process is often called "curing." Thermoset materials do not have a "melting point" but rather degrade upon heating (i.e. covalent bonds in the polymer break).

The Applicant submits that Rosemund is directed to flexible polyurethane foams (see Rosemund et al. Abstract; Col. 1, lines 8 and 25; and Col. 2 lines 16, 60, and 62) whereas the polyurethane layer of the present invention is a thermoset. Therefore, contrary to the Examiner's suggestion, Applicant submits that the polyurethane of Rosemund is thermoplastic and not thermosetting.

Applicant submits that the second layer of the present invention must be a rigid thermoset polymer rather than a flexible thermoplastic material in order to effectively transfer loads from the substrate to the rigid thermoplastic material. That is, the material must have a relatively high shear rigidity and strength for effective load transfer to occur, properties which are characteristic of thermoset polyurethanes, as opposed to flexible thermoplastic polyurethanes.

Furthermore, Rosemund teaches heating the surface of a thermoplastic polyurethane foam in solid state above its melting or fusion temperature, and contacting the melted or fused surface with a substrate to form a bond. As is discussed above, this method of bonding is not applicable to thermosetting materials. The flexible polyurethane foam of Rosemund is not compatible with the method of the present invention because, once injected between the conduit and the thermoplastic liner, it would not be possible to subsequently heat the surface of the flexible polyurethane foam and melt it in order to obtain a bond.

In summary, the Applicant submits none of the references cited by the Examiner discloses the strengthening of a pipe

or conduit. Furthermore, none of the references cited by the Examiner discloses fully and continuously bonding a thermoplastic liner to a thermoset material to rehabilitate a pipe or conduit. Finally, the polyurethane foams of Rosemund are inapplicable to the present invention because they are thermoplastic and require heat to form a bond.

In view of the foregoing amendments and remarks, favorable reconsideration of the Application is respectfully solicited. If, however, the Examiner finds that any issues remain, she is invited to contact Applicant's undersigned counsel to arrange an interview for resolving any such remaining issue.

Respectfully submitted,

Dated:

April 12, 2002

By:

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ANSWER 1 © 2002 ACS

**CAS Registry Number****41618-91-1 REGISTRY****Chemical Name**

2-Propenoic acid, 2-hydroxypropyl ester, polymer with chloroethene and ethenyl acetate (9CI) (CA INDEX NAME)

Acetic acid ethenyl ester, polymer with chloroethene and 2-hydroxypropyl 2-propenoate (9CI)

Ethene, chloro-, polymer with ethenyl acetate and 2-hydroxypropyl 2-propenoate (9CI)

.beta.-Hydroxypropyl acrylate-vinyl acetate-vinyl chloride polymer

.beta.-Hydroxypropyl acrylate-vinyl acetate-vinyl chloride copolymer

2-Hydroxypropylacrylate-vinyl acetate-vinyl chloride copolymer

Poly(vinyl chloride-co-vinyl acetate-co-2-hydroxypropyl acrylate)

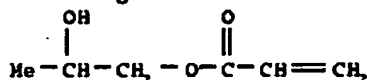
Vinyl acetate-vinyl chloride-2-hydroxypropyl acrylate copolymer

**Molecular Formula**

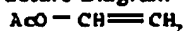
(C6 H10 O3 . C4 H6 O2 . C2 H3 Cl)x

**Component**

CM 1

**Structure Diagram****Component**

CM 2

**Structure Diagram****Component**

CM 3

**Structure Diagram**
**CAS**  
**REGISTRY**

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with the blowing agent from the hose 60 at the gun 68, which is a substantial distance from the nozzle 64, the resin, curing agent and gas should expand substantially by the time the cellular material 54 is shot from the nozzle 64. There is some weight in the cellular material 54, and the thermoplastic sheet 28 must be rigid enough to support this weight when the cellular material 54 has filled the space 36. It has been found that for a conduit 14 of approximately sixty inches or five feet original interior diameter, and where the cellular material 54 is a polyurethane foam having a density of from approximately 17 pounds per cubic foot to 23 pounds per cubic foot, a polyvinyl chloride sheet having a flexural modulus of approximately 500,000 plus or minus 150,000 is suitable. It is believed that the polyurethane foam will perform best and provide the necessary restoration in densities ranging from ten pounds per cubic foot to fifty-five pounds per cubic foot.

The thermoplastic material of sheet 28 is in the preferred embodiment a polyvinyl chloride. The sheet has two faces. A first face 70 faces the space 36 and interior surface 22 of the substrate 18. The second face 71 faces the interior of the substrate 18. The face 70 facing the space 36 is treated prior to installation within the conduit 14, by treating that surface with 2-~~propanoic~~ propenoic acid, 2-hydroxypropyl ester, polymer with ~~chloroethane~~ chloroethene and ethenyl acetate reactive resin having a density of 1.37 grams per cubic centimeter at 25 degrees Centigrade and a molecular weight of from 8,000 to 10,000. The reactive resin may contain a catalyst to enhance and cause a preference for a molecular linkage between the thermoplastic sheet 28 and the thermoset material 54. Such a treatment impregnates the polyvinyl chloride sheet 28 through that surface 70, leaving hydroxyl ions along with the catalyst on the surface 70 available for bonding with the isocyanate or other bonding agent which is part of the curing agent for the thermosetting resin. When the curing agent is mixed with the thermosetting resin in the gun 68, an adequate quantity of the isocyanate is calculated and included when conveying the mixture 54 in the delivery tube 62, for bonding with the hydroxyl ions resulting from the treatment of the surface 70 of the polyvinyl chloride sheet 28. Where the thermosetting resin is polyurethane resin or substantially polyurethane resin, and the curing agent is substantially isocyanates, it has been found

that a volumetric ratio of isocyanate to resin of from 1.02:1 1.10:1 will provide the necessary quantity of the isocyanate.

When the thermoset 54 is filled within the space 36, the isocyanate will chemically bond with the available hydroxyl ions embedded to the sheet 28 to create an integrated, composite structure comprising a polyvinyl chloride region at one end, a region on the other end comprising the cellular thermoset material 54, and, in progressing across the cross-section from one to the other, an interphase region 74 where the polyvinyl chloride with its available hydroxyl ions have molecularly integrated with the isocyanate of the cellular thermoset 54. This bonding is universal and generally complete over the entire active treated area of the first face 70 of the polyvinyl chloride sheet 28, and the corresponding area of the thermosetting material 54 coming into contact with the face 70 after the thermosetting material cures and sets.

The thermosetting resin preferably comprises a polyurethane resin. The resin has mixed in it suitable surfactants, amines and silanes. The characteristic of silane allows the material of which it has been included, to bond chemically with many minerals commonly present in most cementitious, ceramic and metallic substrates, of which most sewer conduits are made. Suitable silanes can be obtained commercially. Silanes will chemically bond with the substrate 18, whether made primarily of concrete or other cementitious material, or clay, brick or metal.

The insertion of the expanded, cellular thermosetting material 54 into the space 36 allows the thermosetting material 54 to work into the pores and interstices 76 of the substrate 18. A suitable surfactant or surfactants may be added to the thermosetting material 54 in order to facilitate such working of the thermosetting material 54 in order to facilitate such working of the thermosetting material 54 into these pores and interstices 76 emanating into the substrate 18 from the corroded surface 22, as more fully described in my patent No. 5,389,692, the description of which is incorporated herein as though fully set forth in detail. The silane in the thermosetting material 54 will chemically bond to the substrate 18, to establish an interphase region 75 between what ultimately becomes the thermoset 54 and the substrate 18. The thermoset material 54 and the substrate 18

corroding elements found in a waste water sewer system. The side or surface of the sheet section 30 which is to be positioned facing the interior surface 22 of the corroded concrete substrate 18 is treated and activated so as to form a chemical bond with materials included in a thermosetting material, such as, in the case of polyvinyl chloride, the impregnation of the surface with a substance that results in free hydroxyl ions that will bond chemically with isocyanate in a thermoset curing agent for a thermosetting resin.

The sheet 28 or layer could be a polyethylene or any thermoplastic. The surface of the polyethylene or other thermoplastic sheet that will face the interior surface of the concrete conduit when fixed into position, can be treated for bonding with the thermoset, by ionizing or roughening the surface with a gas flame propane or methylacetylene propane. The surface may also be prepared by a discharge of electrical energy through the polyethylene or other thermoplastic sheet in a corona spectrum. Other thermoplastic materials may be found suitable.

In a second step 100, a section 30 of the sheet 28 of semi-rigid thermoplastic material is positioned and fixed in a predetermined and pre-selected position or location within the interior of the conduit 14 to define the interior physical dimensions and/or configuration designed by the engineer or designer. In the case of a conduit substantially circular in cross-section, this step defines the ultimately resulting interior diameter. In this step, also, the positioning defines the interior surface that will ~~that will~~ face the waste water in the ultimately restored conduit, including the chemical composition. This surface should be corrosion resistant and impermeable to corrosive gases and liquids. This positioning step 100 also defines the space 36 between the sheet 28 and the corroded interior surface 22 of the substrate 18. The positioning is accomplished by first defining that part or portion of the interior of the substrate, that is to say, what portion of the circumference within the interior of the substrate that is to be restored. As noted herein, I intend and mean to include conduits which are rectilinear in cross-section when describing distances along the circumference of the conduit substrate. The limits or boundary of the interior surface of the substrate that is to be restored, is defined by first installing or



fixing opposing channels into which opposing edges of the thermoplastic sheet can be inserted and thereby fixed. In the preferred embodiment, the channels are filled with a thermosetting material that will receive and set with the sheet to prevent the corrosive elements of the waste water from penetrating between the sheet and the substrate or soaking and damaging any materials therebetween. The next contiguous section is joined to the next previous section by a seam having a channel on both linear side edges for receiving the joining edge of the corresponding thermoplastic sheet sections. These channels also may be filled with the thermosetting material used in the opposing channels formed on the surfaces of the substrate described above, to create a molecular bond between the sections that will resist penetration behind the sheet sections by the corrosive elements of a sewer system.

The seam can be extruded comprising a thermoplastic material, selected and designed to have a substantial strength to provide a linearly spaced, periodic arched hoop, in effect, contributing to the support of the thermoplastic sheet, and of the thermosetting material. Such added strength will also contribute to resisting loading stresses endured by the conduit after restoration.

In a next step 102, the components of a cellular thermosetting material, namely the thermosetting resin, the curing agent and the blowing agent are inserted into the void or space 36 created by the positioning of the thermoplastic within the conduit 14. in the preferred embodiment, the thermosetting resin is a polyurethane resin, and the curing agent is an isocyanate. The resin has mixed in it suitable surfactants, amines and silanes. Normally, the setting reaction between the polyurethane resin and the isocyanate is highly exothermic and destructive to the thermoplastic sheet, by definition. However, I have found that creating a froth foam with a lower mass using carbon dioxide, limits the thermal transfer capabilities between the thermosetting resin 54 and the thermoplastic sheet 28, resulting in little or no thermal distortion. The polyurethane resin, the isocyanate and the initial blowing agent are conveyed in separate hoses from their respective storage locations to a mixing gun portably located at the location of the fixed sheet 28 within the conduit. The gun has an elongated, extended polymer dispensing tube extending from

I CLAIM:

47. A corrosion-resistant chemically continuous composite conduit having an inside and an outside, said conduit comprising from the outside to the inside:

- a) a first layer comprising a porous, mineral-containing substrate;
- b) a second layer comprising a thermosetting material, said thermosetting material containing a silane and a curing agent comprising isocyanate groups;
- c) a third layer comprising a thermoplastic material, said thermoplastic material impregnated with a reactive resin;

wherein an interface between said first and second layers comprises covalent bonds between said silane in said second layer and minerals in said first layer;

wherein an interface between said second and third layers comprises covalent bonds between said ~~isocyanate~~ isocyanate groups of said second layer and said reactive resin of said third layer; and

wherein said first second and third layers are bonded together with sufficient shear strength to transmit and distribute loads between said layers.

48. The conduit of claim 47, wherein said first layer comprises a cementitious, ceramic, clay, brick, or metallic substrate.

49. The conduit of claim 47, wherein said thermosetting material is polyurethane resin.

50. The conduit of claim 47, wherein said thermosetting material contains a surfactant.

51. The conduit of claim 47, wherein said reactive resin is ~~poly(vinyl chloride-co-vinyl acetate-co-2-hydroxypropyl acrylate)~~ 2-propenoic acid, 2-hydroxypropyl ester, polymer with chloroethene and ethenyl acetate.

52. The conduit of claim 47, wherein said thermoplastic material is PVC.

53. The conduit of claim 47, wherein said PVC has a tensile strength of between 5,000 to 10,000 psi.

54. A method for lining a porous, mineral-containing conduit, said method comprising the steps of:

- a) impregnating a sheet of thermoplastic material with a reactive resin;
- b) positioning said sheet of thermoplastic material within the interior of said conduit spaced apart from an inner surface of said conduit;
- c) inserting a thermosetting material between said sheet of thermoplastic material and said inner surface, said thermosetting material containing a silane and a curing agent comprising isocyanate groups;

wherein said silane forms covalent bonds with said minerals in said conduit;

wherein said isocyanate groups form covalent bonds with said reactive resin of said thermoplastic sheet;

wherein said thermoplastic sheet, said thermosetting material, and said conduit are bonded together with sufficient shear strength to transmit and distribute loads between them.

55. The method of claim 54, wherein said ~~first layer~~ conduit comprises a cementitious, ceramic, clay, brick, or metallic substrate.

56. The ~~conduit~~ method of claim 54, wherein said thermosetting material is polyurethane resin.

57. The ~~conduit~~ method of claim 54, wherein said thermosetting material contains a surfactant.

58. The ~~conduit~~ method of claim 54, wherein said reactive resin is ~~poly(vinyl chloride-co-vinyl acetate-co-2-hydroxypropyl acrylate)~~ 2-propenoic acid, 2-hydroxypropyl ester, polymer with chloroethene and ethenyl acetate.

59. The ~~conduit~~ method of claim 54, wherein said thermoplastic material is PVC.

60. The ~~conduit~~ method of claim 54, wherein said PVC has a tensile strength of between 5,000 to 10,000 psi.